DESIGNING BANK BUILDING 10 FLOORS WITH 1 BASEMENT USING PARTIAL DUCTILE SYSTEM IN SURAKARTA

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in partial fulfillment of the requirement
for the degree Bachelor of Civil Engineering

by :

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to

CIVIL ENGINEERING DEPARTMENT FACULTY OF ENGINEERING
MUHAMMADIYAH UNIVERSITY OF SURAKARTA

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ABSTRACTION

Final project is meant to plan a reinforced concrete structure 10 with 1 basement floor, which is the building to the bank of the region Surakarta (earthquake region 3) which stands on solid ground and is based on ISO 1726-2002 with the value of ductility factor (μ) = 2.5 that includes the partial ductile. The purpose of this thesis is to obtain a comparison or efficiency of the planning structure based on the three dimension building, which includes structural mechanics analysis, the distribution of shear loads or seismic and needs reinforcement.

Design of reinforced concrete structures using quality materials that include concrete quality f'c = 25 MPa, the quality of steel fy = 300 MPa and frame the horses using quality steel used Bj 41. Regulation as reference includes PPIUG-1983, SNI 03-1729- 2002, PPBBI-1984, PBI-1971, SNI 03-2847-2002. Analysis of structural mechanics using "SAP 2000 v.14" 3 dimension. Mathematical calculations using the "Microsoft Excel 2007". While the depiction using "AutoCAD 2007".

The results of final project as follows :

1). Roof structure using steel frame frame profile 2L50x50x5 and 2L50x50x6.
2). The thickness of plate floor (1-9) 12 cm with main reinforcement D10 and divisor reinforcement dp8. To plate used stairs and landing plate 12 cm thick with main reinforcement D12 and divisor reinforcement dp8.
3). Beams with dimensions 400/700 mm with main reinforcement D22 and shear reinforcement 2dp8. Column with dimensions 500/500 mm with main reinforcement D25 and shear reinforcement 2dp10.
4). Pile cap using size 4x4 m^2 thick 100 cm with reinforcement D25-100 mm. Piles with dimensions 35 / 35 cm with the main reinforcement 4D22 and shear reinforcement 2dp10-140.

Key words : ***Planning, partial ductile, SAP v.14 3 dimension***

INTRODUCTION

Surakarta is a city that has been growing, the general population there were civil servants, businessmen, bank employees and others. Generally workspace bank building does not move because it is equipped with supporting facilities like space for the archives, meeting rooms, lunch rooms and other supporting activities. So that the safety and comfort need to be considered. Designing a bank building with 10 floors and 1 basement was made because of the development of increasingly rapid Surakarta city and followed by a number of investors who entered both domestically and from abroad. And so we need adequate work space, while it will need more work space that is not matched with the available land in the city of Surakarta, thus resulting in the need for the planned layout of work space vertically in order to carry out activities of economic activity in the city of Surakarta.

Avoid widening the discussion, in the preparation of this thesis is limited to the following issues :

1. The discussion includes the calculation of the roof structure (steel frame) and reinforced concrete structures (plate floors, stairs, beams, columns and foundations).
2. The designing building is a ten floors bank building with one basement in Surakarta using partial ductile system with ductility factor $\mu = 2,5$ and a reduction factor of R = 4,0.
3. Quality of concrete f'_c = 25 MPa and quality steel for division reinforcement f_y = 240 MPa as well as to longitudinal reinforcement f_y = 300 MPa.
4. In this use design regulations as follows :
    a. Peraturan Pembebanan Indonesia Untuk Gedung, 1983.
    b. Peraturan Beton Bertulang Indonesia (PBI) 1971.
    c. Pedoman Perencanaan Ketahanan Gempa Untuk Rumah dan Gedung (PPKGURG-1987).
    d. Standar Perencanaan Ketahanan Gempa Untuk Struktur Bangunan Gedung (SNI 03-1726-2002).
    e. Tata Cara Perhitungan Struktur Beton Untuk Bangunan Gedung (SNI 03-2847-2002).
    f. Tata Cara Perencanaan Struktur Baja Untuk Bangunan Gedung (SNI 03-1729-2002).

LITERATURE

Ductility is the ability of a building structure to undergo post-elastic deviation large and repeatedly back and forth due to earthquake loads upon loads earthquake that caused the first meltdown, while maintaining sufficient strength and stiffness, so that the structure of the building is still standing, though had been on the verge of collapse (SNI 03-1726-2002).

Based on SNI 03-1726-2002 there are 3 planning system, namely :

a. Full Elastic System, namely the structural design of buildings using a value of $\mu = 1,0$ or R = 1,6.
b. Partial ductile system, the structural design of buildings using a value of $\mu = 1,5$ to 5,0 or R = 2,4 to 8,0.
c. Full ductile system, namely the structural design of buildings using a value of $\mu = 5,3$ or R = 8,5.

Guidelines for calculation of concrete structures in Indonesia, listed in the Standard Procedure for Calculation of Concrete Structures for Buildings SNI 03-1726-2002. Guidelines for calculation of concrete structures in Indonesia, listed in the Standard Procedure for Calculation of Concrete Structures for Buildings SNI 03-1726-2002. Some components of the structure includes a strong need, strong and robust nominal or robust plans available

According to Article 11.2 of SNI 03-2847-2002, so that the structure and strength of structural components qualified and suitable to be used on a variety of combinations of load, then it must be filled with the provisions of the factored load combinations as follows:

a. U = 1,4 D
b. U = 1,2 D + 1,6 L + 0,5 (A or R)
c. U = 1,2 D + 1,0 L $\pm$ 1,6 W + 0,5 (A or R)
   U = 0,9 D $\pm$ 1,6 W
d. U = 1,2 D + 1,0 L + 1,0 E
   U = 0,9 D $\pm$ 1,0 E

Earthquake loads is one burden that must be taken into account in the designing of the building structure, particularly for earthquake-prone areas. In this designing guidelines earthquake loads calculated by SNI 03-1726-2002.

BASIS THEORY

1. Designing Steel Frame Roof Structure

   The burdens are calculated on gording include dead loads (due to its own weight and load gording roof cover), live load and wind load. Steel profiles are used to gording canal profile.

2. Designing Structure Floor Plates and Stairs

   Plate is a flat field structure (not curved) which when viewed in three dimensions has a thickness much smaller than the size of the field plate.

   In order risers can be used easily and comfortably

3. Designing Structure Beams With Partial ductile System

   In designing beam analysis includes calculation of beam longitudinal reinforcement and shear reinforcement shear beam.

4. Designing Column Structure With Partial Ductile System

   In the structural design analysis column calculations include longitudinal column reinforcement, shear reinforcement columns and column moments available.

5. Designing Foundation

   Calculation heavy duty pile count tries a fall pile to it compiler charges utilize material of reinforced concrete.

DESIGNING METHOD

Designing data structures include the following :

a. Data collecting
b. Design frame and stair
c. Design beam and column
d. Determine sufficiency beam and column
e. Foundation design
f. Make sketch detail

RESULTS DESIGN

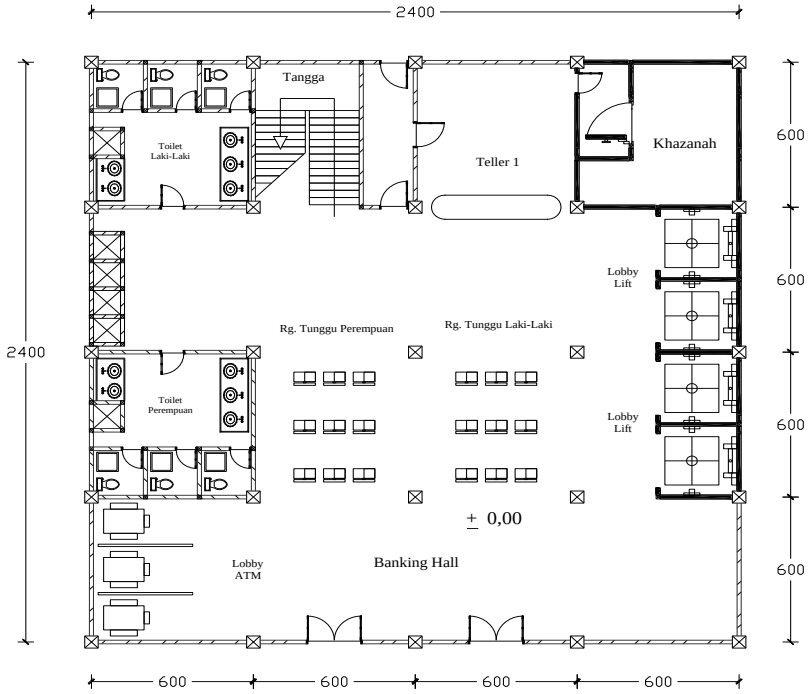

Figure V.1. Building sketch

A. Roof structure planning

Roof structure using the cover of roof a tile. From the results of calculation used gording cannal profile $C_{150x50x20x2,3}$ and roof frame elbow profile $2L_{50x50x5}$ and $2L_{55x55x6}$. Tool connecting bolt ⌀ 3/8 " with thick gusset plate 10 mm.

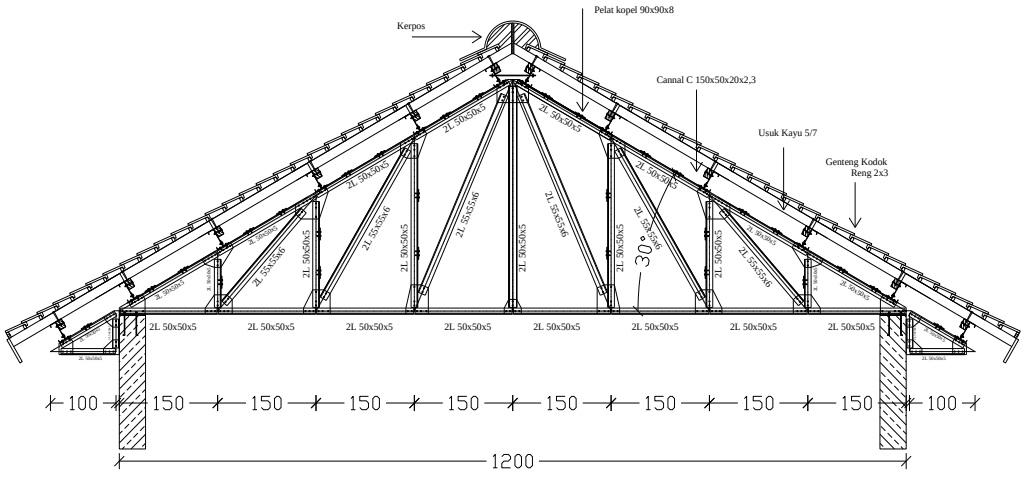

Figure V.2. Steel frame

B. Planning plate

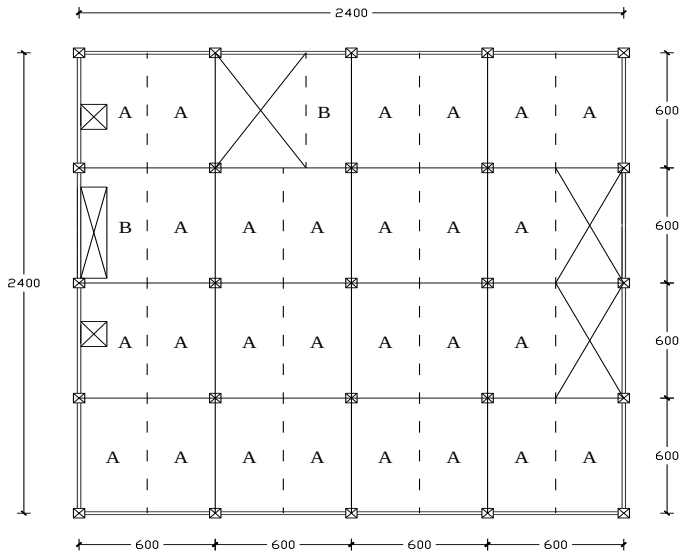

Figure V.3. Plate sketch

Table V.1. Reinforcement and moments plan plate

Type plate	M	Need moments (kN.m)	Main reinforcement	Divisor reinforcement	Plan momment (kN.m)
A	M lx	3,37118	D10 - 140	-	9,887
	M ly	0,98669	D10 - 140	-	8,244
	M tx	-6,82459	D10 - 140	D8 - 180	9,887
	M ty	-4,68677	D10 - 140	D8 - 180	8,244
B	M lx	1,53485	D10 - 140	-	9,887
	M ly	0,29235	D10 - 140	-	8,244
	M tx	-3,03315	D10 - 140	D8 - 180	9,887
	M ty	-2,08301	D10 - 140	D8 - 180	8,244
C	M lx	1,24323	D10 - 140	-	9,887

	M ly	0,23681	D10 - 140	-	8,244
	M tx	-2,45685	D10 - 140	D8 - 180	9,887
	M ty	-1,68724	D10 - 140	D8 - 180	8,244

C. Basement walls

Table V.2. Reinforcement and moments plan basement walls

Type plate	M	Need moments (kN.m)	Main Reinforcement	Divisor reinforcement	Plan momment (kN.m)
E	M lx	28,25696	ϕ12 - 100	-	36,596
	M ly	13,34357	ϕ12 - 100	-	33,992
	M tx	-59,65359	ϕ16 - 100	ϕ10 - 150	61,986
	M ty	-44,74019	ϕ16 - 100	ϕ10 - 150	55,813

D. Basement floor

Table V.3. Reinforcement and moments plan basement floor

Type plate	M	Need moments (kN.m)	Main Reinforcement	Divisor reinforcement	Plan momment (kN.m)
F	M lx	3,65072	ϕ10 - 100	-	17,418
	M ly	3,65072	ϕ10 - 100	-	15,911
	M tx	-9,03989	ϕ10 - 100	ϕ10 - 150	17,418
	M ty	-9,03989	ϕ10 - 100	ϕ10 - 150	15,911

E. Stairs structure

Table V.4. Reinforcement and moments plan stairs structure

Stick	Area	Need moments (kN.m)	Main Reinforcement (Calculate)	Main Reinforcement (Use)	Divisor reinforcement	Plan momment (kN.m)
1 = 4	Left	-19,651	ϕ12 - 90	ϕ12 - 90	ϕ8 - 150	20,958
	Field	9,926	ϕ12 - 150	ϕ12 - 90	ϕ8 - 150	12,985
	Right	-12,393	ϕ12 - 150	ϕ12 - 90	ϕ8 - 150	12,985
2 = 3	Left	-12,393	ϕ10 - 100	ϕ10 - 90	ϕ8 - 150	13,650
	Field	-1,546	ϕ10 - 150	ϕ10 - 90	ϕ8 - 150	11,027
	Right	0	ϕ10 - 100	ϕ10 - 90	ϕ8 - 150	13,650

F. Beam structure

Beam structure calculation results can be seen in the following figure :

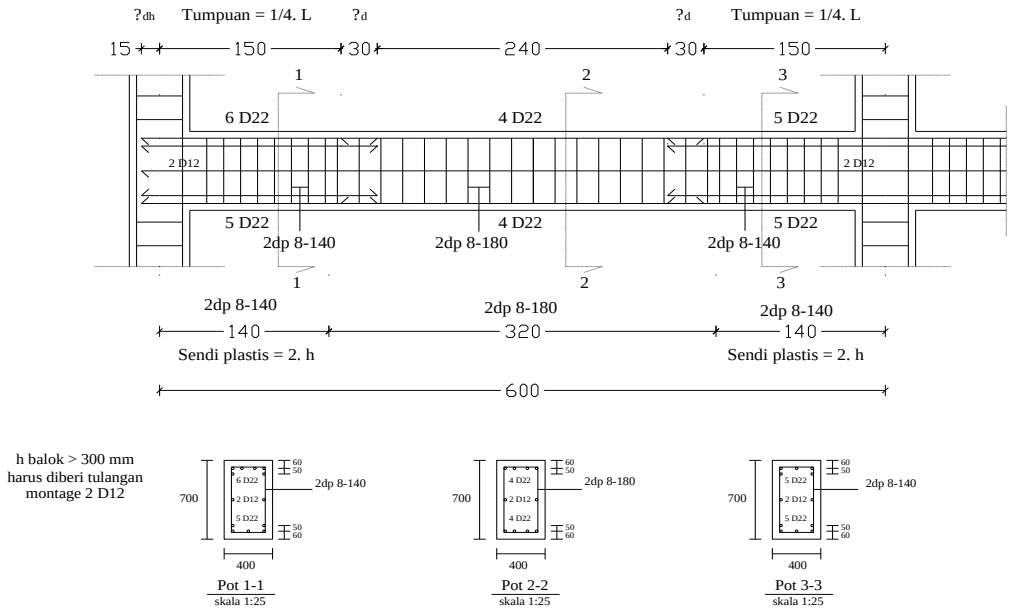

Figure V.4. Results beam design

G. Column structure

Column structure calculation results can be seen in the following figure :

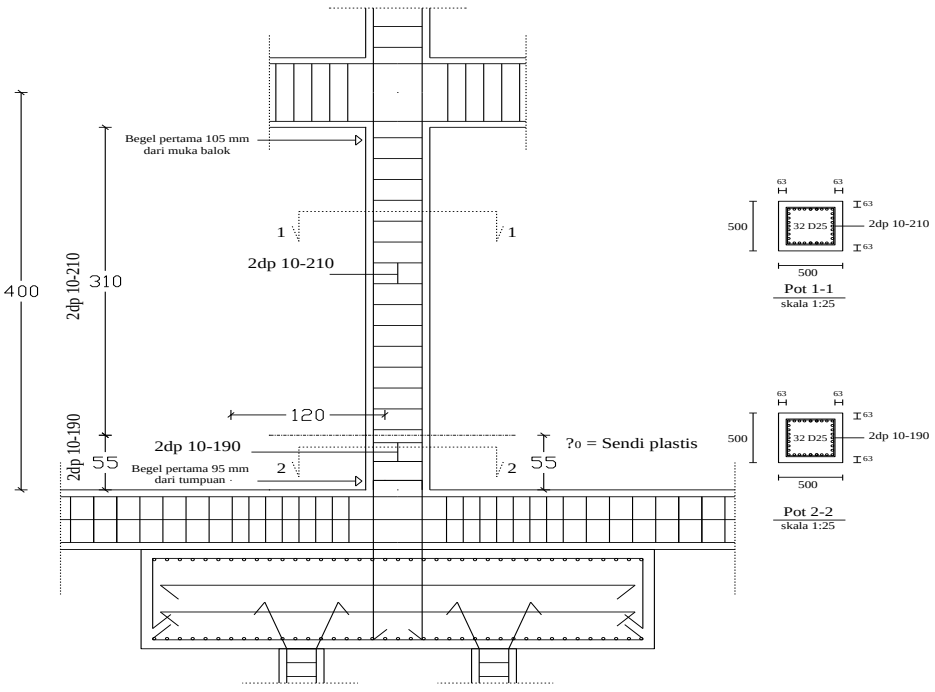

Figure V.5. Results column design

H. Foundation structure

Foundation structure calculation results can be seen in the following figure :

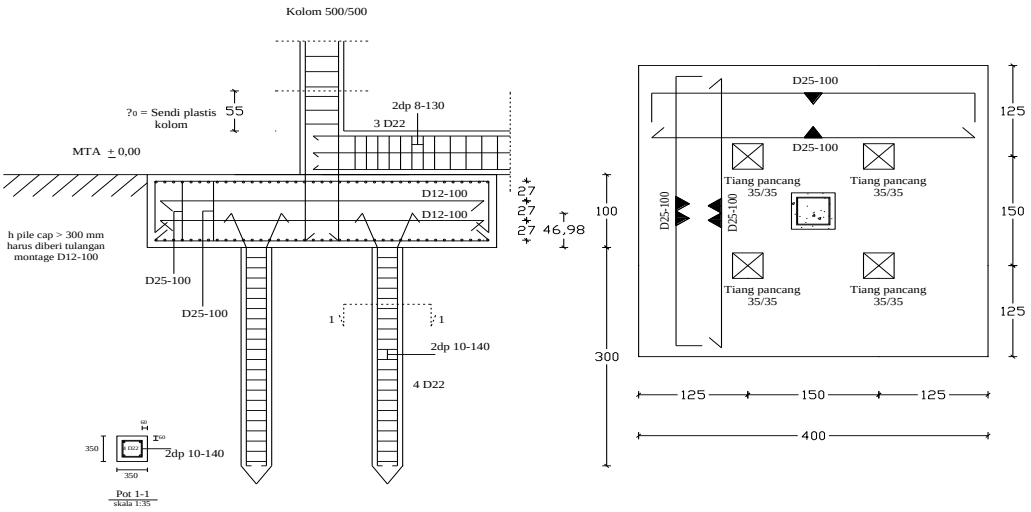

Figure V.5. Results foundation design

CONCLUSIONS AND SUGGESTIONS

A. Conclusions

After analyzing 10 bank building design calculation with 1 basement floor using partial ductile system in Surakarta review 3 dimensional be concluded as follows.

Design of reinforced concrete structures is planned to secure against dead loads, live loads and earthquake loads plan. Shear load distribution / earthquake using equivalent static analysis while calculating structural mechanics analysis using SAP 2000 v.14. The results of the analysis as follows :

1). Roof structure using steel frame frame profile 2L50x50x5 and 2L50x50x6.

2). The thickness of plate floor (1-9) 12 cm with main reinforcement D10 and divisor reinforcement dp8.

3). Stairs structure used by U-shaped the results of the planning climbs 16 cm high and 32 cm wide tread. To plate used stairs and landing plate 12 cm thick with main reinforcement D12 and divisor reinforcement dp8.

4). Portal structure reinforced concrete buildings include :

   a). Beams with dimensions 400/700 mm with main reinforcement D22 and shear reinforcement 2dp8.
   b). Column with dimensions 500/500 mm with main reinforcement D25 and shear reinforcement 2dp10.

5). Foundation structure using pile foundation concrete reinforced and pull until hard soil include :

   a). Pile cap using size 4x4 m^2 thick 100 cm with reinforcement D25-100 mm.

b). Pile group number 4 piles with dimensions 35 / 35 cm with the main reinforcement 4D22 and shear reinforcement 2dp10-140.
c). Sloop with dimension 400/600 mm with main reinforcement D22 and shear reinforcement 2dp8.

B. Suggestions

Things that need attention planning reinforced concrete structures for high rise buildings in general and specifically in this final project author tries give suggestion such as the following:

1. Security, safety and economic factors in planning building is important.
2. At calculation of mechanics analysis SAP 2000 should be taken of the accuracy of the stage running and enter data because it effect on results (output).

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